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DEVELOPMENT OF THE OFFICER QUALIFICATION TEST

FORMS 7 AND 8

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BRIEF

This study reports on the development, standardization, and validation of new forms of the Officer Qualification Test to replace the currently operational forms.

TABLE OF CONTENTS

LIST OF TABLES

DEVELOPMENT OF THE OFFICER QUALIFICATION TEST FORMS 7 AND 8

INTRODUCTION

Originally it was planned to develop three new forms of the Officer Qualification Test, i.e., Forms 7, 8, and 9. However, Form 9 was modified after its development to serve as a base for a new Reserve Officer Candidate (ROC) Selection Test. Though there is no Form 9 of the Officer Qualification Test available for administrative use, development information on Form 9 is presented in this report.

PURPOSE

The Officer Qualification Test needs to be revised periodically to prevent loss of effectiveness due to compromise. This study reports the development, standardization and validation of the Officer Qualification Test Forms 7 and 8 to replace Forms 5 and 6.

PROCEDURE

DEVELOPMENT OF FORMS 7, 8, AND 9

Description. Each new form of the OQT retained the general format and the three sections of previous OQT forms--Verbal Analogies, Mechanical Comprehension, and Arithmetic Reasoning. The

Verbal Analogies section emphasizes understanding of conceptual relations rather than knowledge of vocabulary. The Mechanical Comprehension section calls for ability to understand mechanical principles and ability to apply them to visually presented problems. The Arithmetic Reasoning section measures skill in arithmetic reasoning and problem solving, and requires an understanding of basic arithmetic processes.

Each form consisted of 115 multiple-choice items arranged in order of increasing difficulty within each of the three sections. Testing time was 1½ hours. Each section was not separately timed, although time limits for each section were recommended in the instructions to the examinees. The sections, number of items, and recommended time limits were as follows:

Section	Item Type	Number of Items	Recommended Time Limit
I	Verbal Analogies	35	15 minutes
II	Mechanical Comprehension	30	15 minutes
III	Arithmetic Reasoning	50	60 minutes

Item Selection. Items were selected from previous forms of the OQT, the Officer Selection Battery (OSB), the Officer Classification Battery (OCB), or drawn from general item files. An attempt was made to assure comparability of forms by matching items in terms of content, indices of difficulty, and internal consistency. Difficulty indices ranged from approximately .30 to .85 with a median item difficulty level of .60. Internal consistency values were above .30.

The major difference between the currently operational and new forms of the OQT is in the number of Arithmetic Reasoning items. The Arithmetic Reasoning section of the new OQT Forms contains 30 additional items. This change incorporates a recommendation from a study by Wallack and Guttman (1960), which found that quantitative reasoning items are the most valid predictors of OCS performance.

STANDARDIZATION OF FORMS 7, 8, AND 9

Approximately 1600 applicants to OCS were tested at 39 Navy Recruiting Stations for a 3-month period. One experimental OQT Form (7, 8, or 9) and OQT Form 6 were given to each applicant. To control for possible practice effects, the order of presenta-

tion was balanced by randomly dividing the Recruiting Stations into two groups.[1] In one group, applicants were administered Form 7, 8, or 9 first and then Form 6 (Group A), while the reverse order of administration was given to applicants in the other group (Group B).

Tentative norms[2] were constructed by standardizing raw scores on OQT Forms 7 and 8[3] from Group A against Navy Standard Scores (NSS) on OQT Form 6, using the equipercentile method.

VALIDATION OF FORMS 7, 8, AND 9

Administration. The three new OQT forms were administered to a total of 605 men enrolled in their first week of training at OCS (Class 50), Newport, Rhode Island. Thus, the number for each form was about 200.

Criterion. The basic criterion was performance at OCS. Three operational measures of performance were used. These were:

1. Final average: consisted of a final weighted average of academic and military aptitude grades for those candidates who successfully completed OCS.

2. Total group: used the above scores for graduates and assigned a score of 2.4 to all academic failures (2.5 is the minimum passing grade).

3. Pass - fail: Candidates were grouped into pass-fail categories on the criterion variable.

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[1] An attempt was made to get equal N's. Each group contained about 800 men.

[2] A final standardization is currently being carried out on a different sample of applicants. This followup study is intended to check the reliability of the new norms.

[3] A Bureau of Naval Personnel (Pers 15) decision was made not to make OQT Form 9 operational. Consequently, norms were not constructed. Items from this form were used to construct the Reserve Officer Candidate (ROC) Test, Form 3.

Analysis. Correlations between the OQT total and section scores and the criteria were computed. For the pass-fail criterion, the biserial correlation was used, with the product-moment correlation being used for the other criteria. Validity coefficients for OQT total score were corrected for restriction in range in order to provide better estimates of validities when used in an applicant population.[4]

RESULTS

Standardization

Navy Standard Score (NSS) distributions of OQT Forms 7 and 8 are given in Appendix A.

Table 1 presents means and standard deviations, derived from the standardization sample, of the OQT tests as well as odd-even reliability coefficients of the new forms. A pattern of higher mean scores when a test was given second suggests the presence of a practice effect. Product-moment correlations of Form 6 with Form 7 (r=.84), Form 8 (r=.81), and Form 9 (r=.83) were obtained.

Validation

Table 2 presents correlations of new OQT forms with the three operational criteria. Validity coefficients were uniformly high. When corrected for restriction in range, the total score validities varied between .55 and .68 (uncorrected validities ranged from .51 to .65, with a median of .60) for all three operational criteria. The validity coefficients (uncorrected) for OQT Form 6 were .56 for the final average and .55 for the total group criteria, as compared with Forms 7, 8, and 9 coefficients of .56-.61 and .58-.61 respectively.

Table 3 presents intercorrelations among OQT sections. Means and standard deviations for the OQT tests are also presented.

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[4]Correlations between OQT scores and OCS individual course grades, military aptitude ratings, and OCB scores were also computed, and are presented in Appendix B.

Table 1

Means, Standard Deviations and Reliabilities of OQT Tests

Variable	Group A			Group B			Odd-Even Reliability[a]
	M	SD	N	M	SD	N	
Form 7	57.11	16.14	276	61.96	16.30	293	.924
Form 8	57.75	15.44	252	62.94	14.63	278	.911
Form 9	57.21	15.89	247	61.94	15.59	303	.922
Form 6[b]	48.89	8.43	775	48.09	8.37	874	—

[a]Corrected for total test reliability using the Spearman-Brown correction formula.

[b]Form 6 values are Navy Standard Scores, while other variables are raw scores.

Table 2

Correlations of CQT Forms 7, 8, and 9 with Three Operational Criteria

Variables	Final Average	Total Group	Pass-Fail[a]
Form 6	56	55	—
Form 7	(N=175)	(N=200)	(N=200)
Verbal Analogies	48	50	52
Mechanical Comprehension	41	40	39
Arithmetic Reasoning	52	52	51
Total Score	61 68[b]	60 66[b]	60 65[b]
Form 8	(N=174)	(N=205)	(N=205)
Verbal Analogies	35	42	43
Mechanical Comprehension	30	35	37
Arithmetic Reasoning	52	58	61
Total Score	56 62[b]	61 65[b]	65 68[b]
Form 9	(N=175)	(N=200)	(N=200)
Verbal Analogies	33	39	40
Mechanical Comprehension	38	36	30
Arithmetic Reasoning	59	54	45
Total Score	61 66[b]	58 62[b]	51 55[b]
Mean	3.10	—	—
Standard Deviation	1.63	—	—

[a]Correlations with pass-fail criterion are biserial coefficients. All others are product-moment.

[b]Corrected for restriction in range.

Notes: 1. Product-moment correlations of .20 and biserial correlations of .29 are significant at the .01 level.

2. Decimal points are omitted from the correlation coefficients.

Table 3

Intercorrelations Among OQT Sections

Variables	Form 7				Form 8				Form 9				Mean	Standard Deviation
	1	2	3	4	1	2	3	4	1	2	3	4		
Form 6[a]		(N=125)				(N=131)				(N=123)				
Form 7 (N= 200)	56	66	65	79	53	57	66	75	50	59	69	80	50.24	6.91
1. Verb Anal		33	40	69									20.70	4.98
2. Mech Comp			57	77									18.51	4.68
3. Arith Reas				89									21.06	7.96
4. Total Score													60.26	14.13
Form 8 (N=205)														
1. Verb Anal					25	34	63						20.02	4.61
2. Mech Comp						49	72						19.67	4.58
3. Arith Reas							90						24.36	8.60
4. Total Score													64.04	13.89
Form 9 (N=200)														
1. Verb Anal									41	35	67		21.45	4.74
2. Mech Comp										47	73		17.45	4.13
3. Arith Reas											89		20.54	8.98
4. Total Score													59.44	14.16

[a]Form 6 values are Navy Standard Scores. Other variables are raw scores.

Note: 1. Decimal points are omitted from the correlation coefficients.

DISCUSSION

Results from the standardization sample indicate that the three new OQT forms are comparable in difficulty level and range of scores. The test reliabilities were at least .90. Although there are no data on intercorrelations among the forms, their relatively uniform correlations with Form 6 (.81-.84) indicate that Forms 7, 8, and 9 may be used interchangeably.

Validity coefficients for the three new forms were somewhat higher than obtained with Form 6. The fact that validities with the pass-fail criterion were essentially as high as those with the final average criterion tends to indicate that the forms are at the appropriate difficulty level for selection purposes. That is, the forms are easy enough to discriminate among the borderline cases. For comparison purposes, two other tests which show validity for predicting OCS performance--OCB Mathematics and Advanced Technicians Test (Mathematics)--showed marked differences in validity coefficients (uncorrected) for final average (.50) and pass-fail (.30) criteria.[5]

Efforts to increase the contribution of quantitative reasoning items were apparently successful. The number of Arithmetic Reasoning items was increased from 20 to 50. Correlations between this section and total score for the three forms were about .90, with standard deviations ranging from about 8.0 to 9.0. Comparable figures for Forms 4, 5, and 6 (Classification and Survey Research Branch, 1952) were correlations of .75 to .78 and standard deviations of 3.8 to 4.2. Therefore, correlations with total score for the new forms were higher than with the old forms and variability of scores is substantially higher, thus indicating that the Arithmetic Reasoning section contributes more to the total score in the new forms. The high validities with OCS performance for this section (see Table 2) imply that the change is for the better.

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[5]These tests are part of the current research on construction of the OTB. Data reported here are for OCS Class 51.

SUMMARY AND CONCLUSIONS

New Forms 7, 8, and 9 of the OQT were developed to replace OQT Forms 5 and 6. Each form consisted of 115 multiple-choice items arranged in order of increasing difficulty within each of the three sections: 35 Verbal Analogies items, 30 Mechanical Comprehension items, 50 Arithmetic Reasoning items. This constitutes an addition of 30 Arithmetic Reasoning items over the number used in Forms 5 and 6.

For standardization purposes, each new form was administered, along with OQT Form 6, to approximately 550 applicants at 39 Navy Recruiting Stations. Norms were constructed using the equipercentile method, with Form 6 score as the reference variable.

For validation purposes the new forms were administered to a total of 605 OCs at OCS (Class 50), Newport, Rhode Island. Results showed them to be sufficiently reliable and valid to warrant their operational use as screening instruments in the selection of college graduates for the OCS program.

REFERENCES

Classification and Survey Research Branch. The Navy Officer Qualification Test, Forms 4, 5, and 6: I. Development and standardization. Bureau of Naval Personnel Research Note, 1952, No. 52-2-26.

Wollack, L., and Guttman, I. Speed factors in officer selection measures. U.S.N. Bureau of Naval Personnel Technical Bulletin, 1960, No. 60-5.

APPENDIX A

Distributions of Raw Scores and Navy Standard Scores (NSS) for OQT Forms 7 and 8

Raw Score		
Form 7	Form 8	NSS
102	100-99	70
101-100	98-97	69
99-98	96-95	68
97-96	94-93	67
95-93	92-91	66
92-91	90-89	65
90-88	88	64
87-84	87-86	63
83-80	85	62
79-77	84-83	61
76-75	82-81	60
74-73	80-79	59
72-71	78-77	58
70-69	76-75	57
68-67	74-72	56
66-65	71-70	55
64-63	69-68	54
62-61	67-66	53
60	65-64	52
59-58	63-62	51
57-56	61-60	50
55	59-58	49
54	57-56	48
53-52	55	47
51-50	54-53	46
49	52-51	45
48-47	50-49	44
46-45	48-47	43
44-43	46-45	42
42-41	44-43	41

Raw Score		
Form 7	Form 8	NSS
40-39	42	40
38-37	41-40	39
36-35	39	38
34	38-37	37
33-32	36-35	36
31	34-33	35
30-29	32	34
28-27	31-30	33
26-25	29-28	32
21	27-26	31
23	25-24	30

APPENDIX B

Product-Moment Correlations of OQT Forms 7, 8, and 9 with Criterion Variables

The criterion variables are:

a. OCS Academic Courses

1. Engineering and Damage Control
2. Navigation
3. Operations
4. Orientation and Military Justice
5. Seamanship
6. Naval Weapons

b. Military Aptitude Rating

This rating is a composite of evaluations by the academic instructors and the company officer with his assistant, a chief petty officer. Demerits, masts, and extracurricular activities are considered. Peer ratings may be considered by the company officer in assigning this grade, but no uniform procedure is set forth.

c. OCB Tests

1. Verbal Reasoning
2. Mechanical Comprehension
3. Mathematics
4. Relative Movement
5. Spatial Relations

Table 4

Product-Moment Correlations of OCT Forms 7, 8, and 9 with OCS Academic and Military Aptitude Grades and OCB Tests

Variables	OCS Grades								OCB Tests				
	Engr	Nav	Oper	Orien	Seaman	Wpns	Mil Apt	Total Acad	Verb Reas	Mech Comp	Math	Rel Move	Spat Rel
Form 7 (N=175)													
Verbal Analogies	51	24	45	53	38	38	20	49	74	35	46	31	25
Mechanical Comp.	47	41	38	13	32	42	17	44	54	81	53	49	62
Arithmetic Reas.	43	53	55	34	31	50	10	54	38	54	78	52	47
Total Score	59	53	61	43	42	57	19	64	59	70	78	56	55
Form 8 (N=174)													
Verbal Analogies	40	21	38	46	32	35	06	40	65	26	53	53	24
Mechanical Comp.	38	32	27	-01	20	29	23	30	27	67	45	52	52
Arithmetic Reas.	46	51	54	33	32	48	20	55	42	56	88	57	36
Total Score	56	52	58	36	38	52	22	57	57	67	80	65	47
Form 9 (N=175)													
Verbal Analogies	31	17	36	49	21	31	18	35	72	33	45	19	31
Mechanical Comp.	51	32	34	21	34	33	28	41	38	70	51	46	54
Arithmetic Reas.	47	59	57	44	40	52	26	59	43	57	84	65	50
Total Score	56	53	59	51	42	54	31	62	62	68	82	60	58
Means[ab]	3.05	3.12	3.00	3.09	3.18	3.13	3.18	18.55	52.69	50.85	50.72	44.94	54.12
Standard Deviations[ab]	.23	.27	.23	.18	.18	.21	.14	1.11	8.72	10.65	10.35	8.34	9.85

[a]For OCS Grades, N=624; for OCB, N=605.

[b]OCB values are Navy Standard Scores. Other variables are raw scores.

Notes: 1. Correlation coefficients of .20 are significant at the .01 level.

2. Decimal points are omitted from the correlation coefficients.